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Valorization of agroforestry trees compartments into biobased materials and bioproducts: the case of wood branches

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Background
In many tropical countries, agroforestry systems provide both services for agriculture and for non-food economic sectors (housing and energy).
Since six decades, European countries, including France, have massively excluded trees from the fields and crops in order to intensify mechanized agriculture. But the current agro ecological transition reverse the trend through the design of new agroforestry systems. Nevertheless, French farmers are still to be convinced about the economic reliability of such systems, building their agricultural models on an annual income, which is not so easy with trees that cost annually making economic returns only every few years. Different ways exist to reduce these misgivings, among them the integration of trees products into conventional wood market or to some niche markets. In parallel, wood or chemistry industries are to be convinced of the interest to harvest such woods.
Aim
Trees growing conditions are very different in agroforestry and in forests and so have a large influence on wood qualities that we currently assess making comparative measurements of mechanical, physical and biochemical properties between agroforestry and forestry woods for some given wood species. Agrpforestry farmers having to prune trees in order to control the light flux to the crops, they harvest every year a quite large volume of branches, valorizing them making mulching or energy. But, according to literature, wood of branches shows higher rates of polyphenols than wood of trunks and can open some new markets for branches.
Materials and methods
In the framework of the project “Agrobranche” financed by the French national agency for environment (Ademe), we screen biochemical contents of branches of different sizes from four species collected in two types of agroforestry systems: interplot systems (oak and chestnut); alleycropped system (poplar and walnut). We make first NIRS qualification on branches and tests of natural resistance to decay. Then we chipped the branches before processing chemical extractions and their qualification using UPLC-ESI-DAD-MS and CG-MS analysis in LERMAB, Nancy. For oak and chestnut, we have make comparison of extractives composition and rates between branches and wood of the trunk of the same trees.
Major results and conclusion
The comparison of extractives composition show a higher biochemical variability in wood of branches than in trunks.
NIRS measurements make very effective prediction of the extractive composition determined by direct measurements; it seems possible to develop a NIRS-based rapid and non-destructive method to assess branches biochemical value directly on trees into the crops.
Woods with more extractives resist more to decay than woods from trunks.
These results are promising for new valorisation of branches coming from pruning of agroforestry trees.

Keywords: wood, bioproducts, branches.

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